Name: ____________________ Date: ____________

Polynomial Operations SOLUTION (version 222)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -2x^5 - 8x^3 + 6x^2 - 10x + 4$$

$$q(x) = 10x^5 - 7x^4 - 4x^2 - 5x + 2$$

Express the sum of $p(x) + q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-2)x^5 + (0)x^4 + (-8)x^3 + (6)x^2 + (-10)x^1 + (4)x^0 \\ q(x) &= (10)x^5 + (-7)x^4 + (0)x^3 + (-4)x^2 + (-5)x^1 + (2)x^0 \\ p(x) + q(x) &= (8)x^5 + (-7)x^4 + (-8)x^3 + (2)x^2 + (-15)x^1 + (6)x^0 \\ p(x) + q(x) &= 8x^5 - 7x^4 - 8x^3 + 2x^2 - 15x + 6 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = 4x^2 + 2x - 6$$

$$b(x) = -7x + 3$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$4x^2$	$2x$	-6
$-7x$	$-28x^3$	$-14x^2$	$42x$
3	$12x^2$	$6x$	-18

$$a(x) \cdot b(x) = -28x^3 - 14x^2 + 12x^2 + 42x + 6x - 18$$

Combine like terms.

$$a(x) \cdot b(x) = -28x^3 - 2x^2 + 48x - 18$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 222)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= -3x^3 + 7x^2 + 26x - 29 \\ g(x) &= x - 4 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-4}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	-3	7	26	-29
4		-12	-20	24
	-3	-5	6	-5

So,

$$\frac{f(x)}{g(x)} = -3x^2 - 5x + 6 + \frac{-5}{x-4}$$

In other words, $h(x) = -3x^2 - 5x + 6$ and the remainder is $R = -5$.

5. Let polynomial $f(x)$ still be defined as $f(x) = -3x^3 + 7x^2 + 26x - 29$. Evaluate $f(4)$.

You could do this the hard way.

$$\begin{aligned} f(4) &= (-3)\cdot(4)^3 + (7)\cdot(4)^2 + (26)\cdot(4) + (-29) \\ &= (-3)\cdot(64) + (7)\cdot(16) + (26)\cdot(4) + (-29) \\ &= (-192) + (112) + (104) + (-29) \\ &= -5 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(4)$ equals the remainder when $f(x)$ is divided by $x - 4$. Thus, $f(4) = -5$.